Chapter 7
Governance and Offshore Aquaculture in Multi-resource Use Settings

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Abstract The notion of the sea as a seemingly endless source of resources has long dominated marine governance. This is despite that different perceptions and valuation systems underlie the institutional structures that govern and manage marine systems. Socio-political considerations cover the whole range of stakeholders and their type of involvement in the establishment and operation of multi-use offshore systems. However, within the vast variety of regulations inside the EU, the EU Member States as well as in North America, their implementation for offshore multi-use settings is as yet incipient and examples of best practice in multi-use scenarios are needed. These need to combine different knowledge systems (e.g. authorities, decision-makers, local communities, science, etc.) to generate effective insights into the management of multiple uses of ocean space and to complement risk-justified decision-making. Pre-existing social networks can provide significant political leverage for governance transformations as required for the move offshore. That said, a range of organizational and social challenges related to the collective use of a defined ocean territory have to be taken into account. For instance, the creation and compliance with defined responsibilities and duties or the introduction of cross-sectoral management lines, such as an offshore co-management, that integrates the different demands and practices of the involved parties within an operational scheme that is practical on a day to day manner are in case in point. Indeed, how people perceive and value marine environments and the resources they provide determines individual and collective preferences, actions and strategies in the marine realm. Thus, for the effective

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B.H. Buck and R. Langan (eds.), *Aquaculture Perspective of Multi-Use Sites in the Open Ocean*, DOI 10.1007/978-3-319-51159-7_7

implementation of sustainable marine resource management, the public has to be included in the knowledge production in order to understand processes that take place in our economies, environment and societies which in turn will affect the outcomes of management actions. In the following chapter, Marine Spatial Planning (MSP) approaches, linkages between site-selection criteria's, GIS and modelling towards the multi-use of offshore areas to marine governance are discussed in more detail.

7.1 Introduction

Increasing demand by marine resource users for access to offshore marine environments, especially as a potential solution to improve food security, highlights an urgent need for action to ensure sustainable development of offshore areas is supported by effective management and policy. This should be prioritised by maritime nations worldwide since demand for offshore user rights is likely to grow especially when considering the global aquaculture industry is one of the fastest-growing food producing sectors (FAO 2016). As a commercial sector, marine aquaculture is a relatively young sector which has seen rapid changes particularly in technological advances over the last 4–5 decades (Duarte et al. 2007). Public sector policies play a critical role in the development of this sector (Hishamunda et al. 2014). To illustrate, Hishamunda et al. (2014) credit China's expansion of aquaculture and current prominence to specific policies introduced by central government authorities that promote stewardship among those involved in this sector. Aquaculture policies provide a vision and broad qualitative goals that can, if effectively implemented, support growth of the sector and further frame the roles of the key actors that are to be involved in aquaculture development (Brugere et al. 2010). In this respect, corresponding governance systems need to be considered because success or failure of achieving policy goals cannot be judged on the basis of their theoretical or technical attributes without considering the institutional, political and cultural context in which they are applied (Araujo et al. 2004).

Thus, the role of effective governance in supporting sustainable development of marine aquaculture especially offshore is receiving increasing interest. This is especially valid in countries and regions failing to meet sector growth targets through governments prioritising research and development on production and technology, as is the case in Europe (Stead 2005, 2015). With advances in research and development attracting growing interest in offshore aquaculture as a potential viable investment opportunity it is timely to examine the governance and policy needs required to support its growth in a sustainable way. So far, the Atlantic salmon, *Salmo salar* L., is the most intensely farmed commercial finfish in seawater and considered a suitable candidate for offshore aquaculture. Interest in culturing other marine species offshore, such as aquatic plants like seaweed, molluscs and various finfish, is growing, unlike the availability of appropriate inshore coastal space for marine aquaculture. Thus arguably, the offshore aquaculture sector could

contribute more significantly to the overall aquaculture sector's growth, offering alternative or supplementary solutions for meeting food security challenges and provide a source of income generation, to mention only a few of the possible benefits not always fully realised.

Globally, it has been well recognized that there is an increased need to conserve ocean ecosystems and to use ocean space as efficiently as possible, thus requiring planning for multiple uses of compatible activities, and the development of strategies to promote, enhance, and optimize the multiple uses in order to protect ocean ecosystems and conserve ocean space (Buck et al. 2004; Mee 2006). That said, all of these activities planned in the offshore realm require strong policy backing with effective governance arrangements and clear multi-use management goals in place. Traditionally, the notion of the sea as an endless source of resources has long dominated marine resource management, especially in the fisheries sector where weak governance is recognised to have contributed to unsustainable exploitation of fishery resources. Historically, an absence of institutions governing the sea was highlighted as early as 1968 by Hardin through his seminal article 'the tragedy of the commons'. Furthermore, in the recent efforts in tailoring contemporary institutional structures that govern and manage marine ecosystems, a lack of understanding about the different perceptions and value systems of marine resource users and how these influence human behaviour has surfaced. However, such socio-political considerations over the whole range of stakeholders and their type of involvement in the establishment and operation of multi-use offshore systems has received little attention, thus this chapter is timely in highlighting the role of governance in multi-use offshore aquaculture development.

In the late 1970s, the introduction of the UNCLOS (United Nations Convention on the Law of the Sea) led to successive efforts on governing the offshore commons in a more streamlined approach. Despite not all countries officially ratifying the UNCLOS to date, most have endorsed the concept of the rights and duties pertaining to Exclusive Economic Zone definitions (Buck et al. 2004). Nonetheless, managing the complexities surrounding marine governance issues including equitable access to offshore marine resources requires policies that take account of the structures and principles relevant to decision-making. This chapter provides a broad overview of the role good governance can play in supporting development of the offshore aquaculture sector in an increasingly contested marine environment where multiple use demands robust governance systems.

7.2 Defining Governance, Management and Policy

Managing aquaculture, like much of marine resources management, is often dealt with independently to other marine sectors competing for use of similar areas, for example, fisheries and offshore renewable energy sectors (Stead 2005, 2015). Good governance can help integrate consideration of impacts from decisions made about

different sectors. Good governance is defined herein simply as the process in which decisions are made formally, e.g. government policies and regulations and/or informally codes of conduct from an industry/community and health of marine ecosystems perspective (Stead 2015).

In this chapter we employ the definition by Olsen (2003), who differentiates between management as the process by which human and material resources are harnessed to achieve a known goal within a known institutional structure and governance, which sets the stage in which management occurs by defining—or redefining—the fundamental objectives, policies, laws and institutions by which societal issues are addressed. By fundamental objectives, we refer to the fundamental human rights, e.g. access to a healthy environment. This governs the interest to engage in the various aspects thereof, e.g. maintenance of biodiversity and their related ecosystem services. The concept of governance and management thus focuses on norms, institutions (laws and regulations), organizational structures and processes in the (marine) human-nature context. A lack of understanding about linkages between decision-making by different actors and stakeholders and between different levels at which decisions are made (local industry, national jurisdiction authority and international conventions/treaties) can lead to fragmented and weak governance systems. Indeed, governance is often confused with government and has many meanings depending on the disciplinary view or context in which the term is being applied. The political scientist, Roderick Rhodes (1996) developed a concept of governance which was adopted by the European Commission in their White Paper on European Governance where "European governance" refers to rules, processes and behaviour affecting the way powers are exercised at a European level (EU 2001). Herein, the qualities of good governance are referred to as the 5 "principles of good governance":

(1) coherence, (2) openness, (3) participation, (4) accountability, and (5) effectiveness.

For the purpose of this chapter, it is useful to tailor the definitions of governance, policy and management to the specifics of aquaculture, as these terms are often used interchangeably leading to constraints in implementing sustainable aquaculture development strategies (Table 7.1).

In summary, management of offshore aquaculture is often dealt with independently to marine governance, and even more distant from multi-use approaches. To date, insufficient effort has been directed towards considering and integrating both management and governance in the development of offshore aquaculture sector policy. The hypothesis for debate in this chapter is 'before the offshore aquaculture sector can optimise production regardless of the target species and technology employed, a better understanding of the links between governance structure and offshore multi-use management implementation is required to facilitate growth of this sector'. The next section shares lessons from development of marine governance models in a large marine ecosystem context based on the work by Fanning et al. (2007, 2009) and Mahon et al. (2008, 2011) to illustrate the opportunities or supporting development of the offshore aquaculture sector associated with adopting a multi-level governance framework

Table 7.1 Overview of working definitions for governance, management, policy and ecosystem approach to policy making (*Source* by authors)

Governance	Describes a social function centred on efforts or incentives to steer the actions of humans toward achieving desirable outcomes and avoiding undesirable ones. It covers the fundamental goals, institutional processes and structures which are the basis for planning and decision-making, and sets the stage within which management occurs
Policy	Refers to a set of basic principles and associated guidelines derived from governance that defines the process by which human and material resources are viewed to achieve a defined goal within a known institutional structure. Policy is driven by broader societal issues, for example, food security and/or economic development through offshore aquaculture
Management	Refers to the process of how human and material resources are used to achieve a known goal within a known institutional structure
Ecosystem approach to policy making	Viewed as a potential solution to managing and valuing complex marine ecosystems and measuring policy impact of different sectors such as offshore aquaculture on humans and economic growth. However research methods must consider different response variables when examining relationships between different factors and by using integrated modelling techniques: e.g., Bayesian Belief Networks—which can deal with directly and indirectly related aquaculture data. Ecosystem services sometimes negatively relate to each other and so marine management decisions about offshore aquaculture need to consider interactions and changing values for now and in the future

7.3 Developing a Multi-level Governance Framework for Offshore Aquaculture

In contrast to terrestrial systems, knowledge on marine ecosystems is more limited, e.g. pertaining to the existence of spatial and temporal data, species distribution and data format issues (Martin et al. 2014). Furthermore, ocean governance is still in its infancy as it confronts political, legal and economic development options for ocean use as well as efforts to restore marine ecosystems and the services they provide (WBGU 2013). The recognition of the latter gap is reflected by the significant efforts to develop and reshape various concepts over the last 30 years. These address the objective of influencing marine environments positively and purposively through human and societal engagement by management and governance means. Integrated Coastal Zone Management (e.g. Cicin-Sain and Knecht 1998) and more recently also Coastal and Ocean Governance (Olsen 2003; WBGU 2013) are the most prominent and influential examples (Stead et al. 2002; Stead 2005). With respect to management measures such as marine protected areas, for example, Heylings and Bravo (2007) heralded the benefits of developing a co-management

regime based on strategic vision, participation, and consensus building, while Grafton and Kompas (2005) called for a governance system that uses socio-economic criteria in the development of management goals as well as the physical design of the conservation areas themselves. With regard to the complexities implicit in larger-scale, social-ecological systems (SESs), Norgaard et al. (2009) reported on the lack of clarity from policy-makers and lawmakers concerning setting objectives and accountability. Further, these authors cautioned that because professionals often participate more as individuals than as representatives, the knowledge lines are very fuzzy among different groups thus broader representative views may not always be captured. Also, because adaptive management often does not go beyond theory and demonstration of successes in practice in marine sustainable multi-use management are limited for aquaculture, especially where there is a multiplicity of perspectives confounding interpretation, then initiatives to strengthen interactions among scientists, policy-makers, stakeholders, and the public could help improve benefits associated with adoption of adaptive management for the offshore aquaculture sector.

Thus arguably marine governance is in a nascent stage, and even more so in regard of endorsing offshore aquaculture in a multi-use setting. Thus, for any offshore aquaculture initiative, ocean governance will set the stage in influencing the rate of development for this industry. Governance effectiveness, as defined herein, is influenced by a set of fundamental objectives, followed by a suite of policies, laws and institutions that exist on multiple levels (e.g. local, national and international). Therefore, to debate our hypothesis stated earlier, this section illustrates the importance of having a governance framework to facilitate decision-making. It illustrates this through marine governance research done to support sustainable marine resources management in the Caribbean, using a policy cycle based approach (Fanning et al. 2007; Turner et al. 2014). An adaptive governance framework was useful in helping different countries to identify their strengths and weaknesses in governance structures which can be achieved using a policy cycle exercise to analyse existing arrangements for offshore aquaculture (Fanning et al. 2007). The Regional Ocean Governance Framework (ROGF) developed for the Wider Caribbean for the Caribbean Large Marine Ecosystem (CLME) by Mahon et al. (2012) illustrates the conceptual ‘architecture’ to guide identification at multiple scales and multiple levels and when populated with relevant data shows who are and who are not involved in the multi-use policy processes. Figure 7.1 helps visualise hypothetically linkages vertically (local, national, sub-regional, regional and global) and horizontally (e.g., between sectors such as offshore aquaculture and offshore renewable energy) of governance.

Policy cycles occur at several levels from local, national, sub-regional, regional and global (Fig. 7.1). Within each of these levels there may be many policy cycles. The concept underpinning the policy cycle (Fig. 7.2) is that to achieve effective governance, there must be a complete policy process for decision-making at any level (Fig. 7.1). For an efficient system of governance, the policy cycles need to be complete and there needs to be communication, not only between the different

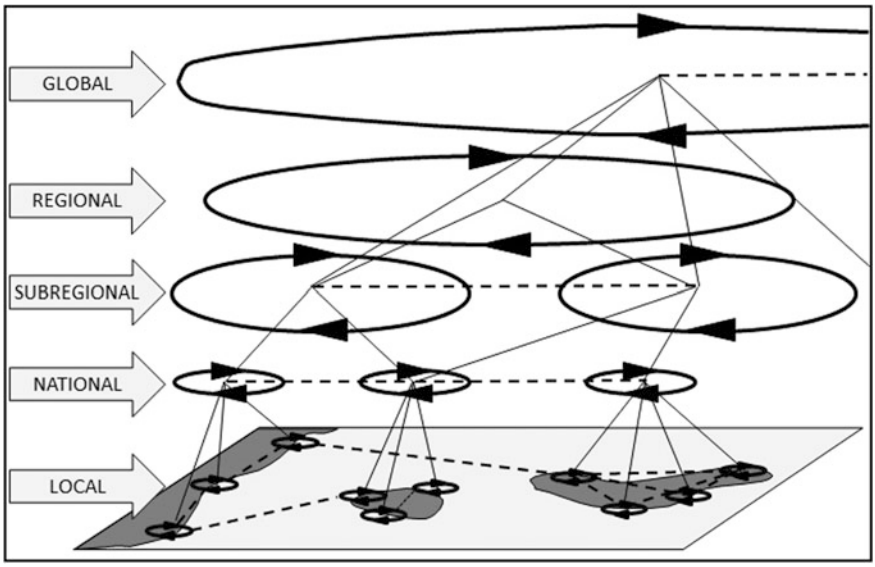

Fig. 7.1 Schematic of linkages between (*vertical*) and within (*horizontal*) levels of governance needed for effective governance. The conceptual Regional Ocean Governance Framework (ROGF) is based on two fundamental parts of the governance system: (i) complete policy processes that are linked *vertically* (nationally and regionally) and *horizontally* (aquifers, lakes, oceans and fresh water systems; sectors such as fisheries and tourism) as shown in Fig. 7.1, and (ii) the policy cycle (see Fig. 7.2) (Fanning et al. 2007)

Fig. 7.2 The 5 stages of the generic policy cycle (redrawn from Fanning et al. 2007). The concept underpinning the policy cycle is to achieve effective governance, there must be a complete policy process. This includes the ability to (i) take up data and information, (ii) generate advice, (iii) make decisions, (iv) implement decisions, and (v) review all aspects of the process

levels of governance (vertical connections in Fig. 7.1) but also across the policy cycles at each level (horizontal connections in Fig. 7.1). There is also an assumption that communication pathways should be two-way allowing for sharing of data and information and improvements in governance using ideas from both higher and lower levels.

National level policy cycle review exercises for the offshore aquaculture sector in a multi-use setting should be undertaken to identify involvement of various actors and players in management and policy. The processes underpinning the different stages in the policy cycle are to ensure (1) appropriate data and information leads to (2) analysis and provision of advice that informs (3) decision-making, which then gets (4) implemented, and subsequently is (5) reviewed and evaluated to determine effectiveness of decisions (Fig. 7.2). The policy cycle review process is useful for: (i) Identifying the government, non-government and private sector stakeholder groups involved in formal and informal governance structures that exist and govern marine resource use both directly and indirectly to the offshore aquaculture sector; (ii) Identifying groups involved in the governance policy cycle; and (iii) Identifying strengths and weaknesses in the policy cycle.

7.4 Knowledge and Information Gaps in Offshore Aquaculture Multi-use Governance

Promoting new forms of governance is by no means the sole responsibility of one institution alone. It is the responsibility of all levels of public authority, private undertakings and organised civil society because good governance—openness, participation, accountability, effectiveness and coherence—are what the public expects at the beginning of the 21st century (EU 2001).

To date, economic viability, technical and environmental barriers remain principal research topics where knowledge is still required to aid creation and exploitation of new multi-use ventures, such as offshore wind farms or open ocean aquaculture (Michler-Cieluch and Krause 2008). In recent years, studies have also started to consider public or specific stakeholder groups' perceptions in relation to the fledgling offshore wind industry and/or to aquaculture development in the open ocean (examples given in Nichols et al. 2003; Robertson and Carlsen 2003; James and Slaski 2006). It has been recognized that powerful stakeholder groups, in particular those directly involved in or affected by innovations, exert a great influence on new developments: they can impact negatively on progress of projects (Tango-Lowy and Robertson 2002) but also contribute positively to the improvement of management processes (Dalton 2006; Apt and Fischhoff 2006).

Two stakeholder analysis by Krause (2003) and Michler-Cieluch (2009) for the North Sea area of Germany revealed that there are different types of actors involved in the offshore realm as compared to nearshore areas. Different types of conflicts, limitations and potential alliances surface. These are rooted in the essential

differences in the origin, context and dynamics of nearshore- versus offshore resource uses (Krause 2003). Whereas in nearshore waters historically well-rooted social networks with traditional use patterns exist, the offshore waters are dominated by large, often international operating companies with limited social networks and engagement with each other. The latter can be viewed as holding "pioneer" mentalities, since the offshore development was initiated with the onset of technical developments in ship building and platform construction. These fundamental differences between the diverse stakeholders in nearshore and offshore waters make a streamlined approach to support multi- use management very difficult (Krause 2003; Krause et al. 2011). This finding was reflected by the recent assessment by the WBGU (2013) that revealed major deficits in the status of ocean governance, which have yet to catch up with the pace of technological advancements which allow an intensification of offshore multi-use resource utilisation. This is in part due to the lack of redundant multi-level institutions in place that are able to communicate local and regional findings in a bottom-up fashion as well as a lack of instruments in place that support good communication vertically and horizontally (Fig. 7.1).

To date, the offshore wind farm operators, perceiving themselves as pioneers, hold "client" ties with the decision-makers, in which other users (such as offshore aquaculture, fisheries, etc.) and their interests are not included in development considerations. Employing good governance would help to find stakeholder-led solutions which could be perceived as "win-win" for multiple stakeholders in the offshore setting, the wind energy operator may improve their public perception (Gee 2010) and engender greater participation in future decision-making processes (Turner et al. 2014).

In practice, undertaking the policy cycle exercise is stakeholder-led and provides a way for actors and players in the offshore aquaculture sector to assess how complete the policy cycle is in a particular country. The exercise provides a basis to inform what, if any, gaps exist at different stages of the policy cycle and what the implications are for effective governance of multi-use approaches to offshore aquaculture operations.

Thus, identification of actors involved in a policy cycle, as well as its strengths and weaknesses, can lead to building awareness of the many organisations that can potentially be involved in offshore aquaculture multi-use governance. Fostering improved communication and cooperation between these organisations at different levels should improve the management of the offshore aquaculture sector at a national level and regionally. Hereby pre-existing social networks can provide significant political leverage for governance transformations as research for example from Chile (Gelich et al. 2010) and the Caribbean (Turner et al. 2014) has shown. Applying good governance principles that includes decisive legislative bodies to determine the specific constitutional rules to be used, possibly through marine spatial planning (MSP), can be useful in understanding the institutional framework required for effective decision-making in multiple-marine resource user settings.

However, the "social embeddedness" (Granovetter 1985) and the role of discreet informal social networks must also be considered alongside formal governance mechanisms to address the probability of collectively concerted action in the offshore realm. Indeed, if viewing offshore aquaculture as a common-property activity within a common-pool resource system, then two issues commonly need to be addressed:

1. cost/benefits and challenges of managing exclusion or the control of access to potential users, and;
2. if each user is capable of subtracting from the welfare of all other users, then to what extent are marine resource users willing to trade-off negative impacts with potential benefits?

In the context of offshore aquaculture, if we consider Hardin's (1968) quote that "this dilemma of the tragedy of the commons has no technical solution"—then in debating our hypothesis we should look more into the social dimensions of offshore aquaculture in a multi-use setting. Therefore, to fully address our hypothesis —'before the offshore aquaculture sector can optimise production regardless of the target species and technology employed, a better understanding of the links between governance structure and offshore management implementation is required'—in practice, workshops should be conducted in each country with an interest in offshore aquaculture. These events should be stakeholder-led and seek to identify the efficacy of current governance processes and governance reform needed to improve sustainable development of this sector.

Focussed workshops of this kind can help governments identify likely structural issues associated with current governance arrangements and determine reforms needed for policy and associated management measures to meet identified constraints for future development of the offshore aquaculture sector (Wever et al. 2015). To address the respective technical, economic, social, and political challenges of offshore as well as established inshore aquaculture production, governance processes must also include the relevant stakeholders in a triple-loop manner as proposed by Pahl-Wostl (2009) over time (Fig. 7.3).

Increasing use of ocean territory demands from the respective actors that they move beyond the narrow focus of business entrepreneurship and consider a more complex picture of the multiple-use challenges. In this sense, comprehensiveness implies to take a wider scope of competing demands on multiple marine resources and stakeholders potentially develop a holistic view of all issues, including those of the other parties involved. Marine spatial planning can be helpful in ensuring information from different sectors and actors is assimilated, which goes beyond a single individual or organizations' priorities. Additionally, an insight into the existing underlying offshore aquaculture sector ideas, competing interests and normative considerations has to be generated to understand complex problems and to overcome misunderstandings. This demands governance processes that are either more results-oriented (e.g. for integrating technical knowledge of the participating sectors) or more process-oriented (e.g. for establishing new linkages between

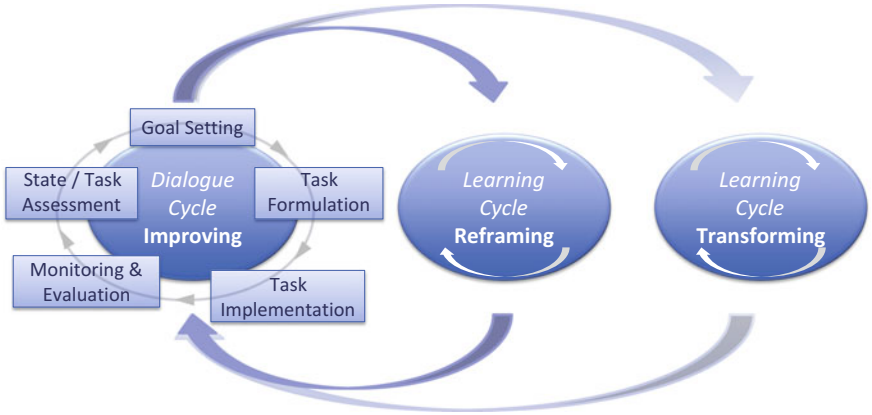

Fig. 7.3 The concept of "triple-loop learning" applied to a multi-use oriented governance regime for the implementation of offshore aquaculture. It is assumed that the different stages of learning among participating stakeholder groups leads to a change in the composition of actor groups and thus effects a change in the institutional framework (Pahl-Wostl 2009)

different groups) than many of today's management systems support (Michler-Cieluch and Krause 2008). How to operationalise highly context-specific processes is a current gap in knowledge for building the institutional arrangements needed to support growth of the offshore aquaculture sector. In this context, it must be stressed that stakeholders are important sources of information which is useful for identifying and contributing to the socio-economic drivers underpinning decision-making in multiple level governance systems which exist offshore.

7.5 Outlook

The strong expansion of offshore wind farms in marine environments, such as in the North Sea, increases the potential competition and likely conflicts among marine resource users especially in sea areas that have formerly been used for other purposes, such as for fishing or shipping activities, or that have been free of human activity and possibly protected. Hence, reconciling the demands of multi-use activities with livelihood and conservation needs will be difficult to balance in practice. Risk and uncertainty associated with starting new businesses are particularly high in such emerging and innovative industrial sectors like the offshore aquaculture industry. Thus a common understanding of uncertainty factors impacting a prospected offshore multiple-use site for aquaculture particularly when combined with renewable energy systems is a first step towards turning some uncertainty factors into more measurable and "controllable" elements. Putting in

place multi-use governance systems that can address these complex issues vertically and horizontally can help stakeholders to consider ways of dealing with anticipated risks.

However, a wide range of *organizational and social* challenges related to the collective use of a defined ocean territory have to be taken into account and preferably during the infancy of a new sector. Governance frameworks can help define responsibilities and duties thus supporting cross-sectoral management associated with offshore co-management that integrates the different demands and practices of the involved parties. It can be postulated that policy drivers will change over time and inform management actions for the future, thus complexity in decision-making is likely to increase where there are demands from multiple users of ocean space. Concomittant changes to the natural, marine, and social ecosystems should ideally be considered in advance of offshore aquaculture developments so that governance systems can be developed to tailor the context-specific needs of different locations. The trajectory of anticipated changes identified through policy workshops (Fig. 7.2) could result in offshore aquaculture businesses providing a more vibrant, innovative, marine economy with compatible management measures supported by appropriate governance systems. To fully address our hypothesis —'before the offshore aquaculture sector can optimise production regardless of the target species and technology employed, a better understanding of the links between governance structure and offshore management implementation is required', then one approach could be to implement national policy cycle workshops to identify the relevant stakeholders and get their buy-into co-develop effective multi-use governance arrangements that will support social, economic and environmental development of the offshore aquaculture sector.

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